therefore, that a fairly good balance should be used, and that the utmost care in its use should be enjoined. When not in use the balance should be covered over with a cardboard box. Becker's No. 51 (Fig. 2) and No. 67 balances, to be had from Townson and Mercer, the English agents, are to be strongly recommended, the former being probably the more suitable, as the pans are carried by "bowed" wires, giving more room for manipulation, when, as in determining relative densities by the hydrostatic method, a bridge to carry a glassful of water is placed across the scale-pan. No. 51 costs £1 17*s.* 6*d.*; No. 67, £2 1*s.* A suitable set of weights (No. 31), from 500 grams downwards to centigrams, costs 18*s.* 4*d.* Even if six balances were provided—and such a number would suffice for a large class—the cost would be but £18.

A convenient size of platinum dish to use is one about ¾ inch deep and 2 inches wide, weighing, with a light cover, about 20 grams. At a normal price of platinum, such a dish would cost about 25*s.*, so that a considerable number might be provided for an outlay of £10. Such dishes not only last a long time when properly used, but are of value when damaged (Note A).

A water oven for drying would cost about £1; one of Fletcher's small air ovens for drying costs 17*s.* 6*d.*

Fletcher's Argand Bunsen burners, with tripod, are to be recommended as superior to the ordinary burners for school work. The smaller size costs 2*s.*; the larger, 3*s.* Suitable black rubber tubing for use with these burners, ⅜ inch in diameter, costs about 9*d.* per foot. A pair of iron crucible tongs costs 1*s.*

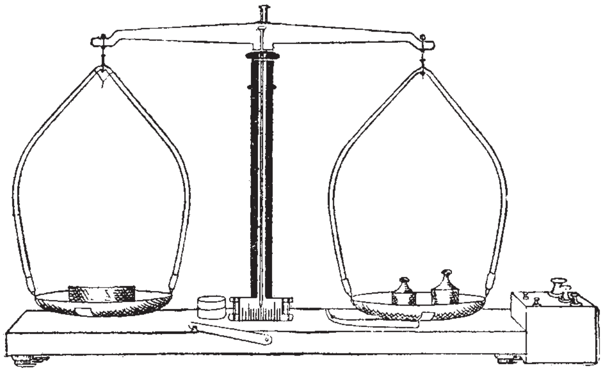


Fig. 2.

The apparatus for measuring the gas evolved on dissolving chalk in acid would cost about 7*s.*, including a 500 cubic centimetre measuring cylinder.

Glass basins about 3 inches in diameter cost 4*d.* each; clock glasses, 6 inches in diameter, 5*s.* per dozen.

50 c.c. burettes cost 3*s.* 6*d.* each.

It is unnecessary to refer to the cost of the few remaining articles required for the suggested experiments, as they are well known. An expenditure of £50 would certainly cover the cost of apparatus required by a class of, say, twenty-four, and which would suffice for the use of several such classes.

Note A.—The unfortunate rise in the price of platinum, which makes the purchase of any number of platinum vessels for school use out of the question, has led me to make a number of experiments in the hope of substituting silver; but, as was to be expected, this has proved to be impossible. I find, however, that porcelain may be used, provided that the heating be effected in a muffle furnace. Small thin hemispherical porcelain capsules may be obtained from the dealers, about the size of the platinum dishes specified, which are more suitable than porcelain crucibles for the experiment. Such dishes may also be used in studying the effect of heat on organic substances, the char being burnt in the muffle furnace.

SCIENTIFIC SERIALS.

American Journal of Science, April.—On allotropic silver, by M. Carey Lea. This paper is in continuation of one contained in the March number of the *Journal*, in which the gold-coloured forms of allotropic silver were examined. The subject now considered is the relation existing between the allotropic forms of silver taken generally and silver as it exists in its compounds, and more especially in the silver haloids. The investigation leads to the conclusion that silver may exist in three forms:—(1) Allotropic silver, which is protean in its nature, may be soluble or insoluble in water, and have almost any colour; but in all its insoluble varieties always exhibits plasticity. It is chemically active. (2) The intermediate form, which may be yellow or green, but is never plastic, and is almost as indifferent chemically as white silver. (3) Ordinary silver. Allotropic silver is affected by all forms of energy, and the effects are strikingly analogous to those produced on silver haloids by the same agencies. It is, therefore, concluded that in the silver haloids silver may exist in the allotropic form.—The phenomena of rifting in granite, by Ralph S. Tarr.—The red-rock sandstone of Marion County, Iowa, by Charles R. Keyes.—The volumetric composition of water, by Edward W. Morley (continued from the March number of the *Journal*). The hydrogen used in the investigation was obtained by the electrolysis of dilute sulphuric acid. By this means it has been found possible to get hydrogen containing less than one-hundreth of a cubic centimetre of nitrogen in two litres of hydrogen, and containing no other impurity in amount large enough to be detected. An apparatus for the measurement of gases has been constructed, in which the mean error of measurement of the volume of hydrogen and oxygen used in the experiments has been less than one part in fifty thousand. With this, twenty experiments have been made, which give a maximum value for the composition of water 2·00047, a minimum value of 2·00005, and a mean value 2·00023. The composition of water may, therefore, be taken as 2·0002 volumes of hydrogen to one volume of oxygen.—On certain points in the estimation of barium as the sulphate, by F. W. Mar. Some experiments made by the author indicate that hydrochloric acid may be introduced freely and without detriment to quantitative exactness, in the precipitation of barium in the form of sulphate from pure solutions. Up to a determined point, the amount of hydrochloric acid employed accelerates the precipitation. The quantity of alkaline salts present is shown to have no very marked influence on the time of formation of the precipitate.—On halotrichite, or feather alum, from Pitkin County, Colorado, by E. H. S. Bailey. An analysis of the mineral shows that it is essentially a sulphate of alumina and ferrous oxide, with a part of the former replaced by ferric oxide, and a part of the ferrous oxide replaced by magnesia.—On a new serpent from Iowa, by R. Ellsworth Call.—On crystallized azurite from Arizona, by O. C. Farrington.—On the occurrence of xenotime as an accessory element in rocks, by Orville A. Derby.—On the magnetite ore districts of Jacupiranga and Ipanema, Sao Paulo, Brazil, by Orville A. Derby.—On pink grossularite from Mexico, by C. F. de Landero.—Restoration of *Triceratops*, by O. C. Marsh.—Development of the Brachiopods, Part 1, introduction, by Dr. Charles E. Beecher.

SOCIETIES AND ACADEMIES.

London.

Geological Society, April 8.—Dr. W. T. Blanford, F.R.S., Vice-President, in the chair.—The following communications were read:—The Cross Fell inlier, by Prof. H. A. Nicholson and J. E. Marr. The tract of Lower Palæozoic rocks lying between the Carboniferous rocks of the Cross Fell range and the new red sandstone of the Eden Valley is about sixteen miles in length, and little more than a mile in average breadth; the inlier extends in a general north-north-west and south-south-east direction, and the normal strike of the rocks is about north-west and south-east. The tract is divided along its entire length by a fault, which separates the Skiddaw slates (with the Ellergill beds of one of the authors, and the Millburn series of Mr. Goodchild) from higher beds on the west. A detailed classification of the Skiddaw slates is not attempted, but the authors describe the succession of the rocks in the faulted blocks of the western portion. Their classification is as follows:—

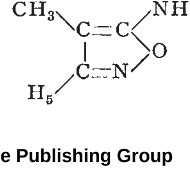
Coniston grits = Ludlow.
Coniston flags (lower portion) = Wenlock.
Stockdale shales = Llandovery-Tarannon.
Ashgill shales
Staurocephalus limestone
Dufton shales and Keisley limestone } = Bala.
Corona beds
Rhyolitic group

A brief comparison of these rocks with those of other regions is made by the authors. Two appendices are added: one, by Mr. Alfred Harker, contains petrographical notices of certain sedimentary and volcanic rocks in the Skiddaw slates, of the volcanic rocks of the Eycott and Rhyolitic groups, and of the principal varieties of intrusive rocks; the second, by Mr. A. H. Foord, contains a description of some Cephalopods from the rocks of the inlier. The reading of this paper was followed by a discussion, in which Prof. Boyd Dawkins, Dr. Hicks, Mr. Rutley, Mr. Hudleston, the Chairman, and Mr. Marr took part.—On the igneous rocks of the south of the Isle of Man, by Bernard Hobson. Omitting the Foxdale granite, the oldest igneous rocks of the island appear to be the diabase dykes of Langness, &c., intrusive in Lower Silurian slates. The Crosby microgranite dyke is also intrusive in these beds, and though its age is difficult to fix, it is probably newer than the Foxdale granite, which appears to be of post-Lower Silurian and pre-Carboniferous age. Next come the volcanic rocks of Lower Carboniferous age—an augite-porphyrite series consisting of tuff, breccia, agglomerate, bedded lava, and intrusive masses exposed in a narrow strip extending from Poolvash to Scarlet Point. A vent seems to have been opened during or after the deposition of the Poolvash limestone, from which fine volcanic ashes were ejected to form marine tuff. At intervals between the eruptions the Poolvash marble was deposited, and became interstratified with the tuff. The vent then probably became plugged up, and, a violent explosion following, supplied material for the agglomerate overlying the tuff. Lava then welled forth, and finally the volcano became extinct, and the intrusive mass of the Stack, regarded by the author as a volcanic neck, was exposed by denudation. It was probably at the close of volcanic activity that a melaphyre dyke was formed, resembling the porphyritic olivine-basalt of the Lion's Haunch, Edinburgh. At Poortown an intrusive mass occurs, provisionally termed augite-picrite-porphyrite, and considered by Mr. J. G. Cumming to be of post-Carboniferous age. Numerous dykes of ophitic olivine-dolerite occur between Bay-ny-Carrickey and Castletown Bay, at Langness, &c. They are post-Lower Carboniferous, and possibly of early Tertiary age. Full details with regard to the development and the macroscopic and microscopic characters of the various igneous rocks are supplied by the author, who acknowledges his indebtedness to Prof. Boyd Dawkins for the use of his geological map and notes. Prof. Boyd Dawkins said that the paper was the first instalment of the results of the geological mapping on the six-inch scale of the Isle of Man, which he had been carrying on for several years, and in which he had been assisted by the author. The igneous rocks of the island presented points of considerable difficulty. The author had, in his opinion, made a valuable addition to our knowledge. Replying to a question put by Mr. Rutley, Mr. Hobson explained that the igneous rocks at Scarlet Point belong to two distinct periods, the augite-porphyrites being of Lower Carboniferous age, while the olivine-dolerite dykes are certainly post-Lower Carboniferous, and perhaps of early Tertiary age.

Royal Meteorological Society, April 15.—Mr. A. Brewin, Vice-President, in the chair.—The following papers were read:—Some remarkable features in the winter of 1890–91, by Mr. F. J. Brodie. The author points out the peculiarities or special features of interest in the weather which prevailed over the British Isles during the past winter. In addition to the prolonged frost, which lasted from the close of November to about January 22, he finds that the barometric pressure for the whole winter was about a quarter of an inch above the average; and that, when the wind was not absolutely calm there was an undue prevalence of breezes from some cold quarter. The percentage of winds from the southward did not amount to one-half of the average. The number of foggy days in London was no less than twice the average. The rainfall over the greater part of the British Isles was less than half the average. The author says that almost every element in the weather has been influenced to an abnormal degree by the remarkable prevalence of high barometrical pressure; and if we were called upon to define the season 1890–91, we should have little hesitation in giving it the name of the "anticyclonic" winter.—The rainfall of February 1891, by Mr. H. S. Wallis. This was one of the driest months upon record, the mean rainfall over England, excluding the Lake District, being only 0·066 inch, or about one-fortieth of the average.—On the variations of the rainfall at Cherra Poonjee, in the Khasi Hills, Assam, by Mr. H. F. Blanford, F.R.S. Cherra Poonjee has long been notorious as having a heavier rainfall than any other known place on the globe, the mean annual fall being frequently given as about 600 inches. Mr. Blanford has made a critical examination of the various records of rainfall kept at this place, and has come to the conclusion that the above amount is too high, and that the average annual rainfall is probably only a little over 500 inches.

Mineralogical Society, April 14.—Mr. R. H. Scott, President, in the chair.—The following papers were read:—On the occurrence of an aluminous serpentine (pseud-ophyte), with flint-like appearance, near Kynance Cove, by Howard Fox.—Note on the occurrence of melanterite in the Upper Eocene strata of the Thames basin, by the Rev. A. Irving.—Notes on various American minerals, including Bastnäsite, oligoclase, quartz, and sapphire, by G. F. Kunz.—On the devitrification of cracked and brecciated obsidian, by Prof. Grenville A. J. Cole.—Notes on crystallites, by F. Rutley.—On a method of observing the absorption spectra of minerals with the aid of the microscope, by Allan Dick.

PARIS.

Academy of Sciences, April 13.—M. Duchartre in the chair.—On the algebraical integration of differential equations, by M. H. Poincaré.—Description of an open manometer 300 metres high established at the Eiffel-Tower, by M. L. Cailletet. The construction of the Eiffel Tower offered exceptional advantages for the installation of a large open manometer, and M. Cailletet appears to have carried out his design with great success. The length of the manometer is 300 metres, hence the pressure which it is possible to attain with the tube filled with mercury is 400 atmospheres. A glass tube would not sustain such an enormous pressure, so a steel tube 4·5 mm. in diameter has been employed. Specially devised stop-cocks are fitted on the tube at intervals of 3 metres. Each of these is connected with a vertical tube of glass about 3 metres high. When any pressure is required the stop-cock at the proper height is opened, and the hydraulic pump set working until the mercury appears in the glass tube that has been put in communication with the steel one. A manometer of this character is of prime importance, as it furnishes a means of accurately testing others, and must be invaluable to M. Cailletet in his researches on vapour tensions and the compressibility of gases.—Report on a memoir by M. de Sparre, entitled "On Foucault's Pendulum."—On the measurement of a new base for French triangulation, by General Derrécagaix. The base chosen is between Villejuif and Juvisy. Its length is 7226·792 metres at 19°·26 C., with a probable error not exceeding a centimetre.—Observations of the Barnard-Denning comet and some new asteroids, discovered by Borrelly and Palisa, made at Algiers Observatory with the telescope of 0·50 metre aperture, by MM. Rambaud and Sy. The comet's position is recorded from April 4–7, Borrelly's asteroid on April 4 and 6, and Palisa's on April 7.—On linear differential equations, by M. E. Vessiot.—On a class of complex numbers, by M. André Markoff.—Relation between the electro-magnetic and electro-static units, by M. H. Pellat. A series of twenty experiments gave the relation as 3·0093 × 10^{10}, and another series of thirty-three experiments gave 3·0091 × 10^{10}. It is pointed out that the number 3·009 × 10^{10} only differs by $\frac{1}{600}$ from Cornu's value for the velocity of light (3·004 × 10^{10}).—On the variation of fusion points with pressure, by M. B. C. Damien.—Transformation of cupreine into quinine, by MM. E. Grimaux and A. Arnaud. Heating to 100° in sealed tubes, for twelve hours, a mixture of molecular proportions of cupreine (the base of *Quina cuprea*) and methyl chloride with an atomic proportion of sodium (the whole dissolved in methyl alcohol), yields quinine. The sulphate possesses all the characteristics of the sulphate of natural quinine. The authors deduce from the experimental evidence given that quinine is the methoxide of cupreine.—On the action of hydrobromic acid upon silicon chloride, by M. A. Besson.—The calorimetric study of platinic chloride and its combinations, by M. L. Pigeon.—The estimation of rhodium by electrolyis, by MM. A. Joly and E. Leidié. The conditions under which this estimation can be accurately carried out are given in detail; the method cannot be employed in presence of nitric or oxalic acids.—On an amidoisoxazol, by M. Hanriot. The preparation and properties of methylethylamidoisoxazol are described. The formula 

is allotted to the new compound. It

is an isomeride of the monoxim of propionylpropionitrile, $C_2H_5 . C(NOH) . CH(CH_3) . CN$, from which it is prepared.—The use of phenylhydrazine for the determination of sugars, by M. Maquenne.—New combinations obtained with certain metallic sulphites and aniline, by M. G. Denigès.—On a violet colouring matter derived from morphine, by M. P. Cazeneuve.—Note concerning aspergillin, a vegetable hæmatin, by M. Georges Linossier. The author controverts the statement of M. Phipson, that aspergillin is identical with palmellin. A comparison of the properties of the two bodies shows many analogies of aspergillin with hæmatin, but none with palmellin.—Note on the influence exerted by neutral mineral salts of potassium upon the solubility of potassium bitartrate, by M. Ch. Blarez.—On the characterization of fig-wine, by M. P. Carles.—A method of recognizing margarine in butter, by M. R. Lézé.—On the process of purification of an alcoholic liquor (from molasses) during rectification, by M. Ed. Mohler.—Artificial reproduction of daubreelite (schreibersite), by M. Stanislas Meunier. Daubreelite has been obtained by treating at a red heat with sulphuretted hydrogen (1) a mixture in the proper proportions of ferrous chloride and chromic chloride; (2) very finely powdered natural chrome iron ore; (3) an alloy of iron and chromium. The last method yields the best result.—On *Clusia* of the *Anandrogyne* section, by M. J. Vesque.—On the existence of the medullary liber in the root, by M. J. Hérail.

STOCKHOLM.

Royal Academy of Sciences, April 8.—The Neuroptera of Scandinavia; Part 2, Neuroptera Trichoptera (*Phryganea*, L.), by the Rev. H. Wallengren.—Further remarks on the history of the vegetation of Greenland, by Prof. A. G. Nathorst.—Studies on enstatite, and the products of its metamorphoses, by K. Johansson.—Research on a group of long-periodical elementary links in the reduction of time, by Dr. K. G. Olsson.—*Tetrao bonasiotetrix*, Bogdanow, a hybrid between the black-cock and *Tetrao bonasia*, by Hr. G. Kolthoff.—Contributions to the knowledge of the Salices in the mountains of the south-west of Jemtland, by Hr. B. Floderns.—Contributions to the knowledge of *Bolocera*, a genus of the Actiniæ, by Hr. O. Carlgren.—On the rate of mortality within a determined age, by Dr. G. Eneström.—On a new sort of hygrometer, by Hr. C. Sondén.—On a new chronometer, which shows the thousandth of a second, exhibited by the inventor, Hr. W. Schmidt.

AMSTERDAM.

Royal Academy of Sciences, March 28.—Prof. van de Sande Bakhuyzen in the chair.—Mr. van der Waals dealt with the pressure of co-existent phases of a mixture, and particularly of solutions of salts and acids. He gives for this pressure a formula, into which enter two parameters, viz. the parameter c of electrolytic dissociation, and the parameter α of physical action; and points out that the solutions of salts and acids may be classified into two groups. For solutions belonging to the first group, for which $(\alpha - 2)\, c > 1$, the relative diminution of pressure per molecule always exceeds 2, and possesses a maximum value. The second group, $(\alpha - 2)\, c < 1$, shows for this diminution a minimum value and a maximum value. To the first group belongs the solution of KOH, to the second group the solution of SO_4H_2 in water.—Mr. Beyerinck spoke of the accumulation of atmospheric nitrogen in cultures of *Bacillus radicicola*. Whilst on a former occasion he had to state experiments with *Bacillus radicicola*, from which he deduced that, under the conditions thereby observed, an absorption of atmospheric nitrogen did not take place, he could now fix circumstances wherein such an accumulation may be obtained. To a decoction of stems and leaves of beans, 2 per cent. cane-sugar was added, and 100 c.cm. of this solution were filled into several Kjeldahl nitrogen balloons, and sterilized under cotton-enclosure. Some of these balloons were infected with very active material of *Bacillus radicicola* var. *Fabæ*, and exposed during eight weeks to a temperature of 5°–15° C. in a semi-obscure part of the laboratory. The matter for the infection was isolated in 1889, from tubercles of Windsor beans, and lately cultivated on a decoction of lucerne-stems with 2 per cent. cane-sugar and 8 per cent. gelatine, this being an extremely good soil for our *Bacillus*. Next to every infected balloon there was put a non-infected one for controlling the nitrogen absorption. A very profuse and interesting vegetation was soon perceived in the infected balloons. This vegetation contained rods, rapid-moving swarming individuals, bacteroids, and "stars." These stars are bacteroids, with many ramifications instead of three. The nitrogen was dosed after Kjeldahl's method, with iodometric determination of the ammoniac. The numbers would certainly have been found greater if the cultures had not been interrupted whilst the bacteria were still growing and swarming with great vigour, as was the case after eight weeks. In the following table the increase of nitrogen, albuminous matter, and bacteria corresponding with this increase—the latter being calculated as containing 75 per cent. water—from twelve experiments are inserted. The increase of nitrogen, 0·0011718 gr. per 100 c.cm., in the second experiment was found as the difference between 0·0061194 gr. in the infected, and 0·0049476 gr. in the non-infected balloon, &c.

	Increase of nitrogen per litre.	Increase of albuminous matter per litre (= N × 6·25).	Increase of bacteria therewith corresponding (= N × 6·25 × 4).
1st experiment ..	0·009114	0·0569625	0·227850
2nd ,, ...	0·011718	0·0731375	0·292550
3rd ,, ...	0·018228	0·1129140	0·451656
4th ,, ...	0·015624	0·0976500	0·390600
5th ,, ...	0·010416	0·0651000	0·260400
6th ,, ...	0·013020	0·0813750	0·325500

It is yet to be determined whether this increase is due to the fixation of free atmospheric nitrogen by the bacteria, or to the complete exhaustion of the environment of all nitrogen compounds by these organisms, and a thence caused "affluing" of the ammoniac or the other nitrogen compounds of the air into the culture-liquid.

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